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# Electrical breakdown phenomena of dielectric elastomers

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Silicone elastomers have been heavily investigated as candidates for dielectric elastomers and are as such almost ideal candidates with their inherent softness and compliance but they suffer from low dielectric permittivity.<sup>[1]</sup> This shortcoming has been sought optimized by many means during recent years. However, optimization with respect to the dielectric permittivity solely may lead to other problematic phenomena such as premature electrical breakdown.

In this work, we focus on the chloro propyl functionalized silicone elastomers prepared in Madsen et al<sup>[2]</sup> and we investigate the electrical breakdown patterns of two similar chloro propyl functionalized silicone elastomers which break down electrically in a rather different way as well as we compare them to a silicone based reference. Thermogravimetric analysis (TGA) and scanning electron microscopy (SEM) are used to evaluate the elastomers before and after electrical breakdown. It was shown the chemically very similar silicone elastomers broke down electrically in very different ways. These observations emphasize that the modification of the silicone backbone may open up for completely new possibilities for stabilizing the silicone elastomer electrically. In order to tailor the elastomers, more knowledge is needed but these copolymers pave the first path towards a better understanding of the complex connection between electrical and thermal stability. Minor changes in the polymer backbone structure result in changes in electrical breakdown patterns and understanding why is crucial for enabling design for extraordinarily stable elastomers and thus ultimately reliable dielectric elastomer based products.

**Keywords:** silicone elastomers, dielectric, electrical breakdown, voltage stabilization, characterization

## References

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